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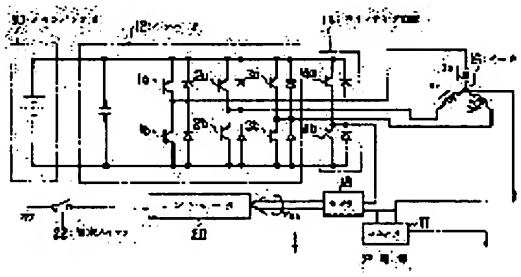
(54) MOTOR CONTROL DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To supply power efficiently from a battery provided on an electric vehicle to a commercial power side, when the commercial power failed.
SOLUTION: A switching circuit 14 is provided parallel to an inverter 12 connected to a main battery 10 provided on a vehicle. When detecting a commercial power failure, a controller 20 controls by PWM the switching transistors 1a to 3b of the inverter 12 and controls the on-off of the switching transistor 4a, 4b of the switching circuit 14, to cause the same current of the same phase to flow in each phase of a motor 16 and thereby to supply power to the commercial power side. No torque is generated in the motor 16 because of the same current of the same phase, which enables efficiently to supply power.



LEGAL STATUS

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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Motor control equipment which is motor control equipment which supplies mounted dc-battery power to a source-power-supply side through said motor at the time of source-power-supply interruption of service, and is characterized by having the control means which supplies this current in phase to each phase of said motor using a power conversion means to supply mounted dc-battery power to a motor.
[Claim 2] Said control means is motor-control equipment according to claim 1 which carries out [having the switching means connected to said power-conversion means and juxtaposition to said mounted dc-battery, an electrical-potential-difference detection means detect the electrical potential difference supplied to said source-power-supply side, and the electrical-potential-difference feedback means which each switch and said switching means within said power-conversion means interlock based on the detected electrical potential difference, and carry out closing-motion control, and] as the description.
[Claim 3] A switching means by which said control means was connected to said power conversion means and juxtaposition to said mounted dc-battery, Based on a current detection means to detect the current supplied to said source-power-supply side, and the detected current, the electrical potential difference of said source power supply is computed. Motor control equipment according to claim 1 characterized by having the electrical-potential-difference feedback means which each switch and said switching means within said power conversion means are interlocked based on the computed electrical potential difference, and carries out closing motion control.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the equipment for supplying power to a source-power-supply side from motor control equipment, especially a mounted dc-battery.
[0002]
[Description of the Prior Art] Conventionally, the technique which supplies power from the mounted dc-battery of an electric vehicle at the time of the interruption of service by the side of a source power supply is proposed. For example, supplying power to a source-power-supply side from a mounted dc-battery, using the power conversion section (inverter) as a battery charger for charge is indicated by JP,6-292304,A. The circuit changing switch which connects a source-power-supply side with an AC motor is specifically prepared, this circuit changing switch is connected to a source-power-supply side at the time of source-power-supply interruption of service, and power is supplied like a mounted dc-battery -> inverter -> AC-motor -> circuit changing switch -> source power supply.
[0003]
[Problem(s) to be Solved by the Invention] However, since motor torque arose and a car may have moved suddenly while supplying power to a source power supply depending on the location of Rota when a permanent magnet motor etc. is used as an AC motor, there was a problem for which it is necessary to lock an electric vehicle in a brake. Moreover, generating of such excessive torque had also become the cause of reducing the effectiveness of an electric power supply. This invention is made in view of the technical problem which the above-mentioned conventional technique has, and in case the purpose supplies power through a motor from a mounted dc-battery at the time of source-power-supply interruption of service, it is to offer the motor control equipment which can supply power efficiently, without unnecessary torque arising by the motor.
[0004]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, using a power conversion means to supply mounted dc-battery power to a motor, the 1st invention is motor control equipment which supplies mounted dc-battery power to a source-power-supply side through said motor at the time of source-power-supply interruption of service, and is characterized by having the control means which supplies this current in phase to each phase of said motor. Moreover, the 2nd invention carries out having the switching means connected to said power-conversion means and juxtaposition to said mounted dc-battery, an electrical-potential-difference detection means detect the electrical potential difference supplied to said source-power-supply side, and the electrical-potential-difference feedback means which each switch and said switching means within said power-conversion means interlock based on the detected electrical potential difference, and carry out closing-motion control as the description in said control means in the 1st invention.
[0005] The 3rd invention is set to the 1st invention. Moreover, said control means The switching means connected to said power conversion means and juxtaposition to said mounted dc-battery, Based on a current detection means to detect the current supplied to said source-power-supply side, and the detected current, the electrical potential difference of said source power supply is computed. It is characterized by having the electrical-potential-difference feedback means which each switch and said switching means within said power conversion means are interlocked based on the computed electrical potential difference, and carries out closing motion control.
[0006]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained based on a

drawing.
[0007] The circuit diagram of this operation gestalt is shown in <1st operation gestalt> drawing 1 . The inverter 12 as a power conversion means is connected to the Maine dc-battery 10 carried in the electric vehicle, and a three-phase-circuit alternating current is outputted by carrying out sequential closing motion control of each switching transistors 1a, 1b, and 2a in an inverter 12, 2b, and 3a and 3b. The permanent magnet motor 16 is connected to an inverter 12, and the current (Iu, Iv, Iw) of the three phase circuit (U phase, V phase, W phase) from an inverter 12 is supplied to the stator coil of a star. Connection of the mounted Maine dc-battery 10 and a mounted inverter 12 and connection of an inverter 12 and a motor 16 are the same as that of the conventional electric vehicle.
[0008] On the other hand, with this operation gestalt, the switching circuit 14 is connected to an inverter 12 and juxtaposition to the Maine dc-battery 10. This switching circuit 14 consists of switching transistors 4a and 4b and diode, and is the same circuitry as one phase of an inverter. And at the time of source-power-supply interruption of service, the connector 17 by the side of a source power supply is connected with a motor 16, and a switching circuit 14 is further connected with a connector 17. Moreover, the voltage sensor 18 which detects the electrical potential difference by the side of a source power supply is connected, and the detected electrical potential difference Vac is supplied to a controller 20. The demand switch 22 which requires that a source power supply should be further set as a predetermined electrical potential difference (100V) will be connected to the controller 20, and if a user turns ON this demand switch 22, based on the electrical potential difference detected by the voltage sensor 18, a controller 20 interlocks, it will carry out closing motion control and will carry out electrical-potential-difference feedback control of each switching transistors 1a-3b of an inverter 12, and the switching transistors 4a and 4b of a switching circuit 14.
[0009] The timing chart which shows the example of the closing motion control by the controller 20 is shown in drawing 2 . The purpose of closing motion control of a controller 20 is making the currents Iu, Iv, and Iw of each phase (U phase, V phase, W phase) of a motor 16 into a corresponding homologous current, as shown in drawing 2 (A). It is because a synthetic field will always serve as zero and the torque of a motor 16 will not be generated, if a corresponding homologous current is supplied to a motor 16. That this current should be realized, a controller 20 carries out closing motion control (PWM control) of the switching transistors 1a, 2a, and 3a to coincidence, as shown in (B), and as shown in (C), it carries out closing motion control (PWM control) of switching transistor 1b, 2b, and the 3b to coincidence. The closing motion timing which switching transistor 1b, 2b, and 3b construct with **** of switching transistors 1a, 2a, and 3a shifts only 1/2 period of the current which should be supplied to a motor 16. That is, PWM control of the switching transistors 1a, 2a, and 3a between 1/2 periods is carried out, and the 1/2 following period turns OFF switching transistors 1a, 2a, and 3a, and carries out PWM control of switching transistor 1b, 2b, and the 3b. And switching transistor 1b, 2b, and 3b are set to OFF the 1/2 following period, and PWM control of the switching transistors 1a, 2a, and 3a is carried out. Moreover, as shown in (D) and (E), you make it these closing motion interlocked with, and closing motion control of the switching transistors 4a and 4b of a switching circuit is carried out. Switching transistor 4a carries out ON control to the same timing as PWM control of switching transistor 1b, 2b, and 3b, and switching transistor 4b carries out ON control to the same timing as PWM control of switching transistors 1a, 2a, and 3a. Thus, by controlling each switching transistor, a corresponding homologous current as shown in (A) flows to U phase of a motor 16, V phase, and W phase, and the current which totaled these is supplied to a source-power-supply side through a connector 17. The electrical-potential-difference value supplied is set as a desired value by controlling the PWM control pulse of each switching transistors 1a-3b of an inverter 12 by electrical-potential-difference feedback so that it may mention later.
[0010] The processing flow chart of the controller 20 in this operation gestalt is shown in drawing 3 . First, a controller 20 judges whether whether the source-power-supply side electrical potential difference's Vac being 0 and a source-power-supply side that is, have failed for power (S101). When the source-power-supply side has failed for power, it judges whether next the demand switch 22 is turned on (S102). A source-power-supply side is interruption of service, and when a user moreover turns on the demand switch 22, a controller 20 performs closing motion control of each switching transistors 1a-4b mentioned above, and supplies power to a source-power-supply side (S103). Supply voltage is controlled to be set to 100V by electrical-potential-difference feedback.
[0011] The block diagram of the electrical-potential-difference feedback control by the controller 20 is shown in drawing 4 . Difference with reference voltage Vref (100V) is computed by detecting the source-power-supply electrical potential difference Vac by the voltage sensor 18, PI control (proportional-plus-integral control) is performed, and it adds to initial current Iint, and considers as reference current Iref. This

reference current Iref is changed into an PWM control pulse by the triangular wave, and the switching transistors 1a-3b which are controlled systems are controlled.
[0012] Thus, with this operation gestalt, if a controller 20 detects interruption of service of a source power supply, since will interlock each switching transistors 1a-3b of an inverter 12, and the switching transistors 4a and 4b of a switching circuit 14, closing motion control will be carried out, a corresponding homologous current will be energized on a motor 16 and power will be supplied to a source-power-supply side, commercial power can be supplied efficiently, without making a motor 16 produce unnecessary torque.
[0013] The <2nd operation gestalt> Although supply voltage was set to 100V with the 1st operation gestalt mentioned above by detecting the electrical potential difference by the side of a source power supply, and carrying out electrical-potential-difference feedback, this operation gestalt shows the example which sets supply voltage to 100V by other approaches.
[0014] The circuit diagram of this operation gestalt is shown in drawing 5 . Although the fundamental configuration is the same as that of drawing 1 and the point that a controller 20 carries out gang control of the switching transistors 1a-3b of an inverter 12 and the switching transistors 4a and 4b of a switching circuit 14, and supplies a corresponding homologous current to a motor 16 is the same, a different point is a point which forms the current sensor 19 which detects the supply current by the side of a source power supply instead of a voltage sensor 17, presumes the electrical potential difference Vac between terminals of a connector according to the detection current Iac, and carries out feedback control.
[0015] The control-block Fig. of the controller 20 of this operation gestalt is shown in drawing 6 . Based on the supply current Iac detected by the current sensor 19, and the electrical potential difference VB between terminals and the terminal current IB of the Maine dc-battery 10, the source-power-supply side electrical potential difference Vac is computed. It can ask for a formula experimentally and it is describing it as Vac=f (VB-IB/Iac) for convenience by a diagram. And it asks for the difference of the electrical potential difference Vac and reference voltage Vref which were computed based on the detection current, PI control (proportional-plus-integral control) is performed, and it adds to initial current Iint, and considers as reference current Iref. This reference current Iref is changed into an PWM control pulse by the triangular wave, and the switching transistors 1a-3b which are controlled systems are controlled. Thus, in this operation gestalt, since power can be supplied to a source-power-supply side and electrical-potential-difference feedback control is moreover carried out based on the detection current value, preventing torque generating of a motor 16 by supplying a corresponding homologous current to a motor 16, it can supply on a desired electrical potential difference (100V) more certainly.
[0016]
[Effect of the Invention] Since according to this invention a corresponding homologous current is supplied to each phase of a motor and power is supplied to a source-power-supply side as explained above, power can be supplied efficiently, without being accompanied by generating of motor torque.

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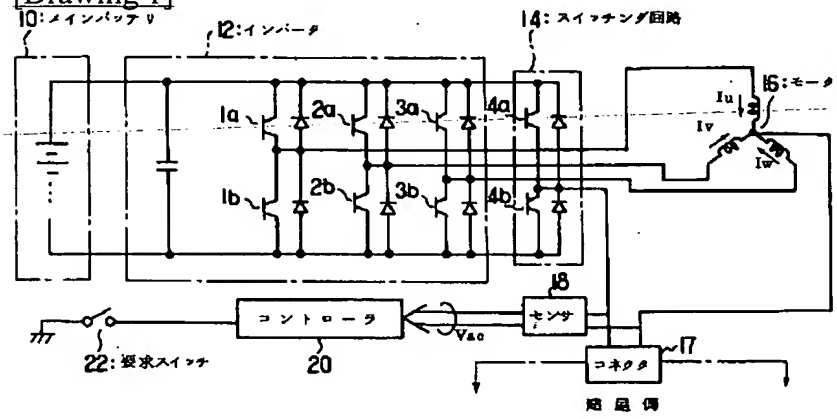
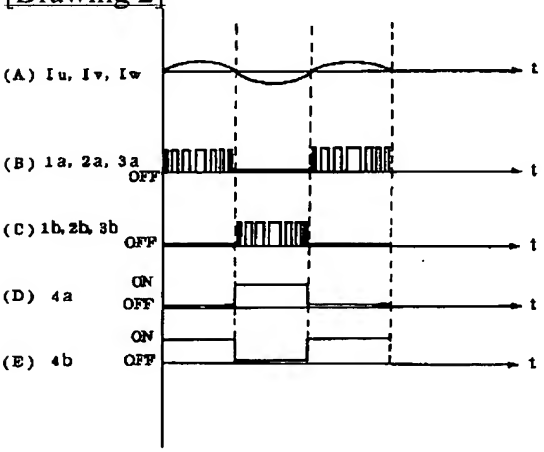
DRAWINGS

[Drawing 1]



[Drawing 2]



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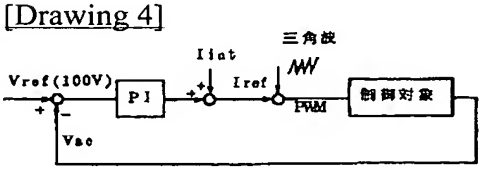
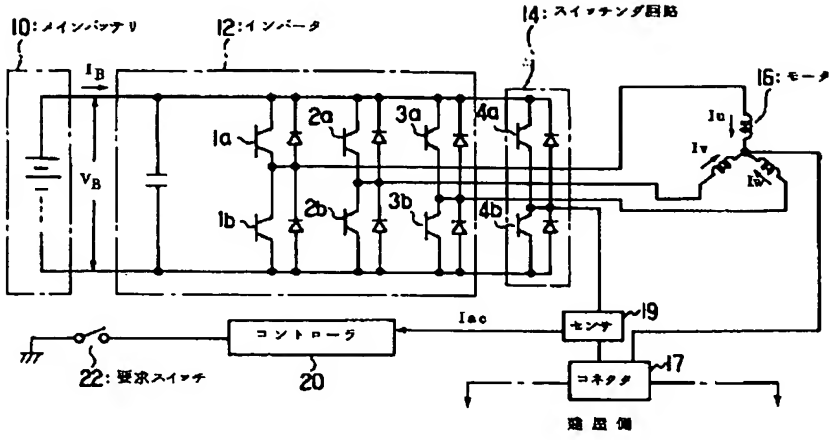
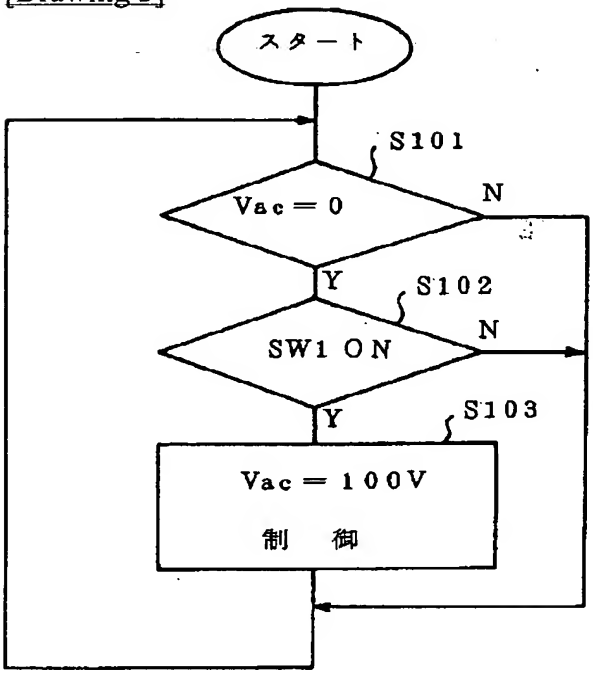


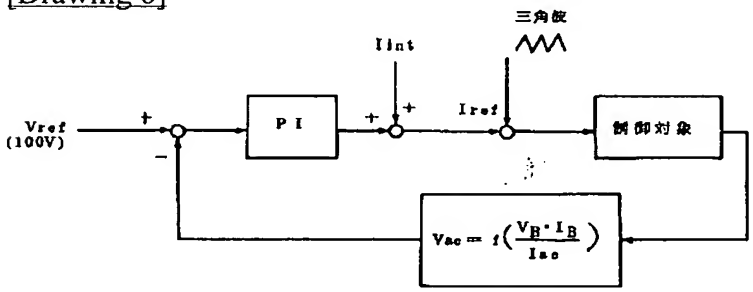
[Drawing 5]



[Drawing 3]



[Drawing 6]



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